INSTITUTE OF GAS TECHNOLOGY
AFFILIATED WITH ILLINOIS INSTITUTE OF TECHNOLOGY
CHICAGO 16, ILLINOIS

# GAS ABSTRACTS

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# GAS ABSTRACTS

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## 1. GAS INDUSTRY

### Air Conditioning

Wollenberger, L. GAS COMPANIES SHOULD PROMOTE ALL-YEAR AIR CONDITIONING. *Gas* 22, 52-54 (1946) *November.*

Air conditioning can be an ideal anchor to secure cooking, water heating, space heating loads. Five reasons why gas is best for air conditioning; seven reasons why gas companies and combined utilties will find it to their advantage to exploit this field.

Editor's abstract

### FPC and Natural Gas Act

Baker, H.H. FPC THREATENS GAS CONSERVATION AND SUPPLY. *Oil Weekly* 123, 90 (1946) *November* 11.

The FPC, set up to administer the Natural Gas Act of 1938, has gradually expanded its power until now, with court approval, it is regulating gas prices at the well. The author feels that unless the powers of the FPC are curbed by amending the Natural Gas Act the conservation of gas and future supply are threatened. In this amendment the Commission should be denied "jurisdiction over the production and gathering, also over-producing and gathering facilities and the price at which the producer or gatherer delivers or sells his gas to an interstate pipe line. The Commission's jurisdiction must be expressly limited to regulation of the trunk line interstate transportation of natural gas and the sale at wholesale of natural gas for resale after interstate transportation is completed."

R. S. Goodrick

### Gas Industry

Tharp, E.M. THE GAS COMPANY'S EQUITY IN INDUSTRY. *Gas* 22, 39-41 (1946) *November.*

While domestic base loads are approaching the ultimate, sales for central heating are booming. To prevent spiraling costs resulting from this imbalance, the author advocates not discouraging central heating installations, but rather building an industrial load that will lower this expensive loadpercentagewise.

Editor's abstract

### Gas Production Research

Hall, E.L. REPORT ON GAS PRODUCTION RESEARCH. *Gas Age* 98, 31-33, 36 (1946) *November* 14.

A resume of the problems studied and the results obtained in the first year of the program of the Gas Production Research Committee. These are discussed under the headings of: Plant Capacities, Development of New Processes, and Basic Studies.

H. R. Batchelder

### Natural Gas Reserves

McGowen, N.C. 148 TRILLION CUBIC FEET. A.G.A. COMMITTEE GIVES FIRST REPORT ON NATION'S NATURAL GAS RESERVES. *Gas* 22, 33-34 (1946) *November.*

The author reports the committee's findings on the natural gas reserves. As of December 31, 1945 the proved recoverable reserves were approximately 148 trillion cu.ft. Of these 111 trillion cu.ft. were non-associated gas, 20 trillion cu.ft. of associated gas and 17 trillion cu.ft. of dissolved gas.

R. S. Goodrick

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## 2. APPLIANCES

### Space Heating Unit

Duchene, M.R. LOW TEMPERATURE HEATING WITH RADIANT TUBES. *Gas* 22, 68-71 (1946) *November.*

The author describes in detail a low temperature radiant space heating unit utilizing polished metal reflectors and consisting of highly emissive metallic tubes, a gas burner effecting laminar flow, either a pressure regulator or a gas flow regulator, and a butterfly valve. In one specific application (drying of paper strips) a working economy of 30% on gas consumption is claimed. Sketches showing possible shapes of tubes, temperature distribution, a radiant heater set up, and a very successful gas regulator are included.

C. Von Fredersdorff

## 3. COMBUSTION AND INDUSTRIAL FURNACES

### Burner Design

Minchin, L. T. THE BURNING OF GASEOUS FUELS. PART II. AERATED FLAMES. *Coke Smokeless Fuel Age* 8, 227-229 (1946) *October.*

The author discusses several of the important points in the design of burners for gaseous fuel—i.e., burner resistance, throat diameter, flame port area, and dimensions at the air port side. A probable mechanism of entrainment, flame stability at varying compositions and cone height of flame are discussed. Relationships between flame port area and air to gas ratio are shown graphically and a plot of flame port area vs. flame velocity and efflux velocity is included.

C. Von Fredersdorff

### Fuel Requirements

UNIT FUEL REQUIREMENTS AT VARIOUS EFFICIENCIES. *Heating & Ventilating* 43, 82-83 (1946) *November.*

The amount of fuel required to produce a given amount of heat at a given system efficiency is just another simple but tedious procedure that engineers are required to go through. The tables presented in this article eliminate this chore work and show fuel requirements per 1000 Btu directly.

Editor's abstract

### Heat Treating Atmosphere

Hotchkins, A. G. and Webber, H. M. A NEW TREATING ATMOSPHERE PRODUCER. *Iron Age* 158, 48-55 (1946) *November* 21.

An atmosphere such as Neutralene, free of carbon dioxide and moisture is, though highly desirable, uneconomical for many applications due to high cost of production. A new technique, whereby heat energy formerly wasted is effectively applied in furnishing heat to the gas producing system, has resulted in considerable reductions in cost and space considerations. The authors describe the newly-devised flow charts and discuss various aspects of Neutralene as an effective heat treating atmosphere.

Author's abstract

## 4. CARBONIZATION AND GASIFICATION

### Carbonization

Wolfson, D. E. and Reynolds, D. A. YIELDS AND PROPERTIES OF GASES FROM BM-AGA CARBONIZATION TESTS AT 900°C. *U.S. Bureau of Mines Tech. Paper* 693 (1946).

About 80 different coals, ranging in rank from lignites to low volatile bituminous coals, have been carbonized in 13- and 18-inch diameter BM-AGA retorts for the purpose of correlating the yields and characteristics of the gases produced with the rank of the coal. The effect of the size of the retort, whether 13- or 18-inch diameter, was found to be negligible on the yields and properties of the gas. The average gas yield in cu. ft. per ton of coal, about 10,450, was nearly the same for all coals of various rank, but the yield of gas on a per cent by weight basis was found to decrease with increasing rank, being 15.4%, 12.3% and 11.1% for high, medium and low volatile coals, respectively. The specific gravity and the calorific value of the gas were found to decrease with the increasing rank of the coal carbonized. The chemical composition of the gas is also a function of the rank of the coal, namely the hydrogen content of the gas increases, and the $CO_2$, CO, $CH_4$, and $C_2H_6$ in the gas decrease with increase in the rank of the coal carbonized. The hydrogen sulfide content of the gas produced is not a function of the rank but of sulfur content of the coal carbonized....This work was carried out at the Central Experiment Station of the U.S. Bureau of Mines in Pittsburgh, Pa.

J. J. S. Sebastian

### Carburetted Water Gas Manufacture

Herbert, S. C. THE LOCKHEED PRINCIPLE. MANUFACTURE OF CARBURETTED WATER GAS. *Gas J.* 248, 775-6 (1946) *November* 6; 839-41 (1946) *November* 13.

The operation of a new carburetted water gas set equipped with the "Lockheed" principle of automatic operation at the Sydenham Works of the South Suburban Gas Co. in England is

described by the author. This principle consists of hydraulic oil power operation throughout for the control of valve movements, interlocking, and emergency shut-down. Electric power is used to feed the coke from the hopper and to drive the oil pump and the controller. The latter contains the hydraulic oil control valves and mechanism indicating plant valve positions, safeguarding the plant from faulty operation. The main control valves are piped in such a manner that, whether their associated plant valve is required to be open or closed in the "shut-down" or "standby" condition, every valve is moved to the "in" position when the plant is shut down. The units used in the Lockheed system are all precision made with accurate fitting, specially developed for hydraulic oil power transmission work. Smaller machines with static grates would scarcely justify the installation of hydraulic oil equipment, but for a 3500 MCF per day set, in which case the automatic control equipment costs 11.5% of the whole, the corresponding figure for hydraulic oil operation is 14.2% of the total investment cost. The increase in cost is only 2.7% of the total cost. The advantages of hydraulic oil operation, as compared to hydraulic systems with water, are considerable, in spite of the cheapness of the latter. Troubles due to corrosion, freezing in the winter, etc., are avoided, but there is a certain amount of fire hazard involved. The ratio of pump output to discharge per minute is 2.86:1.

J. J. S. Sebastian

### Gasification

THE PINTSCH-HILLEBRAND GASIFICATION PROCESS. *Coke Smokeless Fuel Age* 8, 218-220 (1946) *October.*

A detailed description is given of the Pintsch-Hillebrand process developed in Germany for the continuous and complete gasification of brown coal briquettes, peat, and nut size bituminous coal. Synthesis gas (a mixture of CO and $H_2$ in 1:2 ratio) is produced by supplying the heat required for the carbonization and subsequent gasification of the fuel by the recirculation of part of the gas made, which together with added steam is preheated to about 2400°F. in intermittently operating regenerators heated with producer gas. The fuel is continuously charged into the conically shaped "low temperature zone" where drying and devolatization take place. From here passing downward through the annular space into the "gasification zone," the coke formed reacts with the upward flowing superheated steam to form blue gas. Part of the blue gas thus formed and all of the primary gas from the upper zone are recycled and preheated over the hot checker-bricks of the regenerator, where the tar vapors and gaseous hydrocarbons decompose, and are passed through the fuel bed. The first large Pintsch-Hillebrand plant was erected at the hydrogenation plant of the Union Rheinische Braunkohlen Kraftstoffe at Weseling, near Cologne, Germany. It has eleven units each of about 200 MCF hourly capacity, and eighteen gas producers each of about 107 MCF hourly capacity, using brown coal briquettes as fuel. The details of the construction of the unit are shown in a cross-sectional view, and the operation of the process is illustrated by a flow diagram. Operating results are given in several tables. The heating value of the gas produced, depending on the fuel gasified, ranged from 274 to 280 Btu per cubic foot (60, 30 sat., gross). The gas yield ranged from 41,000 to 67,000 cubic feet per U.S. ton, the lower figure for peat and the higher for nut size bituminous coal. The brown coal used at the Weseljng plant yielded 60,000-61,000 cubic feet of gas per U.S. ton.

J. J. S. Sebastian

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## 5. NATURAL GAS AND NATURAL GAS CONDENSATES

### Carbon Black

Gallie, J. F. CARBON BLACK MANUFACTURE. *Petroleum Processing* 1, 197-206 (1946) *November.*

The manufacture of carbon black, especially by the newer furnace methods, has climbed steeply during the war years to all-time highs as shown in the graph. Channel, thermal, and various furnace methods of carbon black production are described and analyzed with respect to both quantity and quality of yields.

Although the homologous methane series takes first rank as a raw material, methods have been devised for using olefins, diolefins, acetylene and anthracene. In his concluding section, the author discusses the economics of using natural gas as a raw material for carbon black manufacture, and takes issue with the view that it is more important to make higher priced products (e.g. plastics and synthetic rubber) from natural gas than it is to make cheaper products (e.g. carbon black).

Editor's abstract

## Conservation

Weber, G. ARK.-LA.-TEX. HAS GOOD GAS-CONSERVATION RECORD. *Oil Gas J.* 45, 82-83 (1946) *November* 2.

Gas sales, natural gasoline manufacture, repressuring, pressure maintenance, cycling, and even some chemical manufacture, are being developed more and more to utilize "oil-well gas" in this important area. Some of the current projects and key figures are given herein.

Author's abstract

## Control of High Gas Pressures

Williams, N. ABNORMAL GAS PRESSURE CONTROLLED. *Oil Gas J.* 45, 60-63 (1946) *November* 30.

Abnormally high gas pressures were encountered by the Sun Oil Company in two South Texas wildcat wells. Pressures as high as 9,500 psi were encountered at depths of about 10,000 ft. Emergency measures were necessary to control the first well, but the second well was adequately handled on the basis of this experience. Drilling details are given.

J. D. Parent

## Cycling

Williams, N. BATEMAN FIELD CYCLING OPERATIONS MORE THAN DOUBLED BY NEW PLANT FACILITIES. *Oil Gas J.* 45, 72-75, 79 (1946) *November* 30.

With the aid of new equipment the volume of gas handled daily has risen from 30 MMCF to 70 MMCF. Rather complete field and process details are given.

J. D. Parent

## Cycling Plant

Love, F. H. NEW CYCLING PLANT FOR CARTHAGE. *Petroleum Engr.* 18, 178-182 (1946) *November.*

This plant is jointly owned by Lone Star Producing Company and Rogers Lacey Interests. It is connected to 15 producing wells which are about 6,000 feet deep and have a shut-in pressure of about 2,650 psi. Two injection wells are now in use, and a third is being drilled. The plant is designed to handle 100 MMCF of gas per day. At present 50% is being recycled. Cycled gas is treated in an absorber at 2150 psi and compressed to 3550 psi. The gas for commercial consumption is treated in an absorber at 1200 psi, dehydrated and sent to the pipe line.

J. D. Parent

## Enriching with Natural Gas

Symonds, G. AVAILABILITY AND PRICE OF NATURAL GAS FOR MIXING AND ENRICHING. *Natural Gases* 1946, 9-12 (*November*).

Paper presented before the A.G.A. in October. A general statement of the factors operating to force a higher heating value of send-out gas, to be met in the author's opinion only by blending or replacing with natural gas. Some discussion of reserves and predictions of price trends.

H. R. Batchelder

## Enriching with Natural Gas

Symonds, G. NATURAL GAS FOR MIXING, REFORMING AND ENRICHING MANUFACTURED GAS. *Gas Age* 98, 38-40, 72 (1946) *November* 14.

The author feels that there will be plenty of natural gas for many years to come if careful conservation, regulation and price control is practiced. It is pointed out that one-half trillion cu. ft. of casinghead gas is wasted annually in Texas due to the fact that the expenses attending recovery are too great to permit economical processing. Mr. Symonds feels that a greater price should be paid to the gas producer so that it would be economical to conserve gas. Further, this would not represent a large per-

centage increase to the ultimate consumer. Thus, Tennessee Gas and Transmission Co. pays 5c/MCF to the producer and sells it in West Virginia for 20c/MCF. The wholesaler sells it for 40c/MCF. If the producer were paid 10c the ultimate consumer would only pay 45c; by so doing the producer's price would be doubled while the consumer would only pay 5c more on each 40c purchase.

J. D. Parent

## Gas Condensate Reservoirs

Thornton, O. F. GAS-CONDENSATE RESERVOIRS. A REVIEW. *Oil Gas J.* 45, 189-199 (1946) *November* 16; *Oil Weekly* 123, 42-51 (1946) *November* 18.

Condensate differs from crude oil considerably in composition. The former is generally high in the volatile hydrocarbons and lean in heptanes and higher, while crude oil contains a considerable proportion of the heavier hydrocarbons. The color, gravity and gas content are usually quite different. Thus, condensate generally has a gas to liquid ratio of 10,000 to 100,000 cu. ft. of gas per barrel of oil, while crude generally has 100 to 1,000 cu. ft. of gas per barrel of oil. Three types of condensate are recognized: wet-gas, retrograde gas and reservoir liquid. The first two types are gaseous under conditions prevailing in the well whereas the third type is liquid. The first type cannot produce liquid when isothermally depressurized, so that its temperature is greater than both the critical temperature and the cricondentherm. The second type yields some liquid when isothermally depressurized, and its temperature lies between the critical temperature of the mixture and the cricondentherm (or highest temperature at which the liquid and vapor phases can coexist). Its pressure is greater than the dew point pressure for the given temperature and composition. The third type is similar to the others, but its temperature is less than the critical temperature of the mixture while its pressure in the well is greater than the bubble point pressure of the mixture for the given temperature. Thus, all types are similar, the major difference being in the relation of bottom-hole temperature to the critical temperature for the given composition. It is to be understood that the wet gas will produce some condensate at lower temperatures than that which exists in the well. Operating methods should be based on the nature of the gas-condensate and of the reservoir. For example, some operations are concerned primarily with efficient recovery of the gas condensate while others are concerned primarily with the recovery of liquid hydrocarbons. Cycling is used extensively to maintain pressure in the well when handling retrograde gas so as to prevent liquid from settling out in the well and being lost in the sand. However, cycling is of little importance for wet gas unless as a means of underground storage. Since cycling operations have proved that a reservoir containing gas-condensates functions as a unit, there is almost universal agreement now that unitization of operating and royalty interests is necessary for efficient and fair operation.

J. D. Parent

## Gas Pulsation

Stephens, F. DAMPENERS NEUTRALIZE EFFECTS OF GAS PULSATIONS. *World Petroleum* 17, 82-84 (1946) *November.*

The author explains the Fluor system of eliminating pulsation in pipe lines. The preferred system involves an installation of dampeners on both the suction and discharge sides of the compressor. It is usually of the manifold type for multicylinder service. The cylindrical tanks which are used are said to be filter devices, offer high resistance to pulsative flow and low resistance to steady flow. It is stated that it is practical to make a design for a pressure drop of 0.5 per cent of the operative pressure that will remove 95 per cent of the pulsation effect. Vibration in piping, compressor inefficiency, errors in metering and other troubles are said to result if pulsations are not eliminated. These troubles are discussed in some detail.

J. D. Parent

## Hydrate Separation

Hutchinson, A. J. L. (to Fluor Corp. Ltd.) SEPARATION OF HYDRATE-FORMING COMPONENTS OF GASEOUS MIXTURES. *U.S.* 2, 410, 583 *Nov.* 5, 1946.

A chlorinated hydrocarbon is used with water for contacting the raw gas so as to have a lower

equilibrium pressure. Subsequent separation of the hydrocarbon and chlorinated hydrocarbon when released from the hydrate is necessary. Partial hydration before the final treatment with water and chlorinated hydrocarbon is covered. The prime purpose is fractionation of the hydratable hydrocarbon from the non-hydratable components of a mixture.

J. D. Parent

## Injection of Gas

McWilliams, L. L. SOURCE AND PURIFICATION OF GAS SUPPLY. *Oil Weekly* **123**, 38-42 (1946) *November* 25; *Oil Gas J.* **45**, 306-312 (1946) *November* 16.

This paper covers the types and sources of gas for injection. It lists the undesirable gases which sometimes occur in the injection media, and describes the difficulties these undesirable gases will cause. The paper outlines the methods of testing for the undesirable gases and the present known methods to purify by eliminating or reducing the difficulties encountered. Finally, the report deals generally with the economics of purification.

Author's abstract

## Pressure Regulators

LaViolette, W. A. USING NORDSTROM VALVES AS PRESSURE REGULATORS. *Gas* **22**, 46-48 (1946) *November.*

Increasing line pressure to meet growing demands poses many problems, among which some of the most important stem from pressure drops. Specially-constructed devices installed by the author on a Nordstrom valve reduced pressure drops to a safe minimum, and helped level out low-demand-high-pressure, high-demand-low-pressure characteristics.

Author's abstract

## Propane Storage

LIQUEFIED PROPANE STORAGE INSURES REFINERY FUEL SUPPLY. *Petroleum Refiner* **25**, 488-489 (1946) *October.*

Standby hook-up liquid propane storage provides emergency fuel supply for refinery. Liquid propane vaporizes on demand and feeds into a gas balance drum to blend with other fuel gas sources. The balance tank operates to provide a constant gas pressure and volume.

C. B. Folkrod

## Repressuring

Barnes, K. 11,667 PRODUCTIVE ACRES REPRESSURED IN WEST PAMPA COOPERATIVE PROJECT. *Oil Gas J.* **45**, 66-71 (1946) *November* 9.

The West Pampa, Texas Panhandle, gas-repressuring program is marked by its size, cooperative basis, complete planning, and application to a dolomite pay. The area covers 11,667 productive acres and includes 26 active operating companies. The area includes 895 producing wells and is being repressured through 75 gas-injection wells in active service.

C. B. Folkrod

## Repressuring

Gray, R. L. and Hobbs, N. M. LANGLIE UNITIZED REPRESSURING PROJECT. *Oil Weekly* **123**, 32-37 (1946) *November* 25.

The results of five years of operation under a gas-injection program are summarized. The project known as the Langlie Unitized Repressuring Project is located in southeastern New Mexico. The project was started when the average reservoir pressure was 615 pounds per square inch (original pressure was estimated at 1400 psi). After five years of injecting gas into two wells, the average pressure had declined to 467 psi in the 13 wells. The average gas-oil ratio at start of injection was 2000 cubic feet per barrel, and is now about 11,000 cubic feet per barrel. The greatest operating problem, the channeling of gas, has been solved to a certain extent by controlling injection of gas by packers. It is estimated that recovery by gas injection ultimately will be 43.5 per cent greater than primary operation for injection period, or 14.8 per cent greater for entire life. (Presented before the Division of Production at the 26th Annual meeting of the American Petroleum Institute, Stevens Hotel, Chicago, November 12, 1946.)

Author's abstract

### Reserves

Deegan, C. J. and Williams, N. SOUTH TEXAS GIANT. U.S. SECOND LARGEST OIL FIELD, SECOND LARGEST GAS FIELD, LARGEST CONDENSATE RESERVOIR. *Oil Gas J.* 45, 60-64 (1946) *November* 9.

With potentially proved reserves of from 1¼ to 1¾ billion barrels of condensate, and from 10 to 15 trillion cubic feet of gas, a line of fields along the Vicksburg Flexure in South Texas appears to be merging into a single large producing area from 45 to 50 miles long and from 3 to 7 miles wide. High spots in the development and linking of these fields, and some of the major engineering and geological problems involved in their operation are presented in this article.

Author's abstract

### Secondary Recovery

Dahlgren, E. G. PRESSURE MAINTENANCE PROJECTS ON THE INCREASE IN OKLAHOMA. *World Petroleum* 17, 74-76 (1946) *November.*

Pressure maintenance and secondary recovery means such as water flooding and restoring pressure by gas injection in old fields are being used to an increasing extent in Oklahoma. The author describes projects now underway in the state.

J. D. Parent

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## 6. PETROLEUM AND SYNTHETIC LIQUID FUELS

### Polyform Process

Hirsch, J. H., Ostergaard, P., and Offutt, W. C. CORRELATION OF OPERATING VARIABLES IN THE POLYFORM PROCESS. *Oil Gas J.* 45, 225, 227-228, 230, 233, 235 (1946) *November* 16; *Petroleum Refiner* 25, 570-574 (1946) *November.*

A generalized correlation based on pilot plant data has been prepared to make the most effective use of the Polyform process in refinery operations. The yields, throughputs and product characteristics were related to (1) character of charge, (2) extent of recovery and recycling $C_3$ and $C_4$ fractions, (3) pressure and (4) index of severity. The index of severity is based on the production of "$C_2$'s and lighter."

C. H. Riesz

### Polyform Process

Offutt, W. C., Ostergaard, P., Fogle, M. C., and Beuther, H. NAPHTHA POLYFORMING. *Oil Gas J.* 45, 180-182, 185, 188 (1946) *November* 16; *Petroleum Refiner* 25, 554-562 (1946) *November.*

In the Polyform process the naphtha charge is utilized to absorb the $C_3$ and part of the $C_4$ fractions from the stabilizer overhead vapors. This mixture is thermally cracked at 1025-1125°F. at 1000-2000 psig. An increase in pressure from 1000 to 1500 psig improves the yield of gasoline about 4 per cent by volume. A further pressure increase to 2000 psig gives an additional 1% by volume but 1500 psig appears to give optimum economic return. A correlation of yield and octane improvement with octane number of charge and characterization factor for 1500 psig polyforming is given. The process can be altered to produce a maximum of butenes-butanes; 12.5% by volume was obtained from an eastern Venezuela naphtha.

C. H. Riesz

### Polyform Process

Offutt, W. C., Ostergaard, P., Fogle, M. C., and Beuther, H. NAPHTHA POLYFORMING WITH OUTSIDE GAS. *Petroleum Refiner* 25, 563-569 (1946) *November.*

The Polyform process can be adapted to convert various $C_3$ and $C_4$ products into 75-80 ASTM octane gasoline. The olefin content of the gas stream and the character of the naphtha affects yield data. It was found that with 60% propylene in the added $C_3$ gases, 100% conversion of the outside gas to motor gasoline was possible. Normal butane is easier to convert to

gasoline than propane, while olefinic $C_4$ gases produce gasoline with less gas circulation than normal butane. The flexibility of the process can be utilized to balance the seasonal refinery butane requirements.

C. H. Riesz

### Polymer Gasoline

Newman, W. R. IDLE ISOMERIZATION UNIT CONVERTED TO PRODUCE POLYMER GASOLINE. *World Petroleum* 17, 69-71 (1946) *November.*

A butane isomerization plant was converted to non-selective catalytic polymerization operation at a cost of $14,000. Daily production of 81-3 ASTM octane polymer is 150 to 200 barrels.

C. H. Riesz

### Synthetic Fuels from Natural Gas

Alden, R. C. CONVERSION OF NATURAL GAS TO LIQUID FUELS. *Oil Gas J.* 45, 79, 81-82 (1946) *November* 9; *Calif. Oil World* 39, *No.* 20, 5-16 (1946) *October.*

The production of synthetic gasoline in Germany by means of the Fischer-Tropsch process is discussed briefly. Because of the necessity for the removal of the heat of reaction amounting to 7000 Btu per pound of product and for the elimination of sulfur in the synthesis to 0.1-0.2 grains of sulfur per 100 cubic feet, the plants were complex and costs were high. Natural gas is a much better raw material than coal for the process; on the basis of raw material requirements alone, coal must sell for 80 cents a ton to be equivalent to natural gas. The ease of handling natural gas, of purifying it from sulfur and of converting it to synthesis gas are all factors to be considered. Since large amounts of natural gas are required (50 to 70 million cubic feet for a 5000 barrel per day plant), location of the plants must be near large gas fields. With the application of the fluid technique, iron catalyst and low cost oxygen for synthesis gas production, it is estimated that 75-80 octane number gasoline can be produced for approximately 5 cents per gallon. It is believed that within the next five years several commercial units will be in operation. If these are successful, and with further improvements in the process, the use of coal may become competitive within ten years.

C. H. Riesz

### Synthine Process

Weil, B. H. and Lane, J. C. THE SYNTHINE PROCESS. IV. BASIC ECONOMICS AND THE CURRENT SITUATION. *Petroleum Refiner* 25, 587-598 (1946) *November.*

This is the fourth and final article of a series summarizing the literature pertaining to the Synthine (Fischer-Tropsch) process. The process offers little prospect of materially bettering low petroleum prices but does appear potentially capable of meeting them. Estimates of the costs of production from coal and from natural gas are reviewed. Currently, Carthage Hydrocol, Inc., will construct a $15,000,000 plant at Brownsville, Texas. Other companies active in developing the process are Standard Oil & Gas Company, M. W. Kellogg, Standard Oil (New Jersey), Standard Oil (Indiana), and the Texas Company. The Bureau of Mines is conducting a $30,000,000 research program on synthetic liquid fuels over a period of five years. A considerable portion of this program is to be devoted to research on the Fischer-Tropsch process. 360 references.

C. H. Riesz

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## 7. ANALYTICAL METHODS AND TESTS

### Carbon and Hydrogen Determination

Tunnicliff, D. D., Peters, E. D., Lykken, L., and Tuemmler, F. D. DETERMINATION OF CARBON AND HYDROGEN BY COMBUSTION. UNITIZED DUAL APPARATUS AND IMPROVED PROCEDURE. *Ind. Eng. Chem.* 18, 710-718 (1946) *November.*

A dual unitized combustion apparatus and improved procedure are described for the determination of carbon and hydrogen in macrosize

samples. The dual feature, absence of rubber connections, provisions for adequate combustion control, and well-defined procedure all combine to give accurate results in the minimum of time. Other noteworthy features are control and indication of all gas flow rates, adequate and convenient pyrometer temperature indication, addition of extra oxygen between the sample and catalyst, use of carefully determined combustion and operating conditions, and a method for accurate analyses of volatile samples. Using the long, precision procedure, a skilled operator can make two determinations in an 8-hour day with a precision of ±0.008% hydrogen and ±0.009% carbon and a probable accuracy of 0.011% hydrogen and 0.015% carbon. Using the short, routine procedure, one experienced operator can make as many as eight determinations daily with a precision of ±0.02% hydrogen and ±0.05% carbon and with a probable accuracy of 0.05% for each element. Both procedures are applicable in presence of sulfur, halogens, nitrogen.

Author's abstract

## Electron Microscopy

Hiller, J. ELECTRON MICROSCOPY. *Bull. Amer. Ceramic Soc.* 25, 438-445 (1946) *November* 15.

The fundamental principles involved in the production of highly magnified images by means of the electron microscope are discussed briefly. A general explanation of the mechanism of image formation is given. It is emphasized that the electron microscope is primarily a means of extending the research worker's sense of vision and that it must be used accordingly. Thus the information provided by the instrument concerns the size, shape, and organization of the structures in the specimen. Observation is limited to solid materials which can be prepared in sufficiently thin layers or which are suitable for the replica technique. A general review is given of the various uses to which the electron microscope has already been put, although it is pointed out in this connection that an understanding of the nature of the information contained in an electron-microscope image is a better guide to its possible uses. A number of references are given.

Author's abstract

## Electron Microscopy

Schuster, M. C. and Fullam, E. F. PREPARATION OF POWDERED MATERIALS FOR ELECTRON MICROSCOPY. *Ind. Eng. Chem. Anal. Ed.* 18, 653-657 (1946) *October.*

A discussion is given of the basic problems involved in the preparation of powdered materials for electron microscopy, with special reference to effecting and maintaining an adequate dispersion of ultimate particles. Various tested methods are described for forming thin films of clear resins and for mounting dispersed powders on these films. Procedures are also given for dispersing and mounting powders suspended in resin solutions. The properties and application of various resins and solvents are described, and electron micrographs of several types of mounts are shown. These procedures for mounting particulate materials should be helpful for extension and refinement of the techniques of sample preparation for the electron microscope.

Author's abstract

## Halogen and Sulfur Determination

Sundberg, O. E. and Royer, G. L. MICRO-DETERMINATION OF HALOGENS AND SULFUR USING THE GROTE COMBUSTION APPARATUS. *Ind. Eng. Chem. Anal. Ed.* 18, 719-723 (1946) *November.*

Automatic combustion methods for the determination of sulfur, chlorine, bromine, and iodine are described. By the use of a modified Grote combustion tube in combination with volumetric procedures, satisfactory micromethods have been developed. The indicators used are dipotassium rhodizonate for sulfur, dichlorofluorescein for chlorine and bromine, and starch solution for iodine. The largest standard deviation for these methods was found to be ±0.14% for sulfur, ±0.10% for chlorine, ±0.17% for bromine, and ±0.15% for iodine in the group of compounds analyzed. Methods are also described for the acid-base titration of sulfur (in the absence of acid-forming elements other than carbon) and for the determination of traces of chlorine employing a turbidimetric estimation of the chloride ion.

Author's abstract

## Nitrogen Determination

Marcali, K. and Rieman, W. III. KJELDAHL DETERMINATION OF NITROGEN. ELIMINATION OF THE DISTILLATION. *Ind. Eng. Chem. Anal. Ed.* 18, 709-710 (1946) *November.*

A macro method for determining nitrogen without performing the usual distillation was developed. The essential steps involved are: (1) oxidation with hot concentrated sulfuric acid in the presence of potassium sulfate and a mercury catalyst; (2) neutralization of excess sulfuric acid with 10 N alkali having sodium bromide present to prevent the precipitation of mercury compounds; and (3) titration of the ammonium salt with standard 0.1 N sodium hydroxide in the presence of formaldehyde. Laboratory data are shown for 32 tests on various organic compounds; the average error of these results being -0.04% nitrogen. Interfering precipitates are formed by elements such as calcium, barium, copper and iron; phosphorus also interferes due to the nature of the reaction that occurs during titration. It is claimed that elimination of the distillation saves approximately 20 minutes per determination.

H. Hakewill

## Particle Size Determination

Pieters, H. A. J. and Hovers, J. SEDIMENTATION ANALYSIS. *Fuel* 25, 138-147 (1946) *Sept.-Oct.*

A method is described for particle size analysis of powders in the range of 1 to 50 microns. This is a modification of the Andreasen sedimentation pipette method. By using several sampling taps at various heights, it is possible to reduce the time required for an analysis, and at the same time provide means for checking on the occurrence of coagulation in the suspension. Butyl alcohol, octyl alcohol and 90% acetic acid are shown to be good dispersing media for powdered coal. Typical results are shown for loess, clay, coal and barytes.

M. Fisher

## Sulfur Determination in Gas

Oldach, C. S. and Field, E. IDENTIFICATION OF SULFUR COMPOUNDS IN GAS MIXTURES. *Ind. Eng. Chem. Anal. Ed.* 18, 669-672 (1946) *November.*

A special saturator was designed for the purpose of stripping the organic sulfur components from a gas by means of oil scrubbing. The gas under test is passed through the oil saturator at a rate of 0.005 cubic foot per minute and close check is kept on the total sulfur content of the scrubbed gas by converting unabsorbed sulfur compounds to hydrogen sulfide which is subsequently analyzed colorimetrically. Upon plotting the volume of treated gas against its sulfur content a curve is obtained from which identification and quantitative estimation of sulfur compounds can be made. In its present stage the method has not been proven for analysis of gases of known composition, but it is based upon theoretical consideration of Henry's and Raoult's laws and upon some experimental work done on manufactured and coke-oven gases. This method offers an excellent means for simultaneously identifying and estimating organic sulfur and other compounds in gases and should find wide application as soon as more extensive data are available to prove its suitability in various situations. Further work with synthetic mixtures is also required to show the limits of accuracy and precision that may be expected.

H. Hakewill

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# 9. ORGANIC CHEMISTRY

## Equilibrium Constants for Butadiene Production

Brickwedde, F. G., Moskow, M. and Aston, J. G. EQUILIBRIUM CONSTANTS OF SOME REACTIONS INVOLVED IN THE PRODUCTION OF 1, 3-BUTADIENE. *J. Research Natl. Bur. Standards* 37, 263-279 (1946) *November.*

Thermodynamic functions including free energy, enthalpy, entropy and heat capacity are given for butadiene, benzene, cyclohexane, ethane, ethylene, ethyl alcohol, water, graphite, hydrogen and oxygen. Equilibrium constants for a number of reactions involved in butadiene production have been calculated and comparisons are made with experimental data.

S. Katz

Abstractor's Note:
It seems unfortunate that the authors made no comparison between their data and similar recent tabulations by the Bureau of Standards (*Gas Abstracts* 1, *No.* 2, 23 (1945). Heat capacities of graphite, for example, differ by as much as one per cent in the upper temperature range, although it would appear that in both papers similar methods of computation were made from the same primary data.

### Ethylene from Coke Oven Gas

Howat, D. D. ETHYLENE PRODUCTION IN BRITAIN—III. *Coke Smokeless Fuel Age* 8, 222-223, 229 (1946) *October.*

An examination of the possibility of using coke-oven gas as a source of this valuable raw material for a synthetic chemical industry.

Author's abstract

### Pyrolysis of Pentenes

Gorin, E., Oblad, A. G., and Schmuck, R. F. PRIMARY PROCESS IN PYROLYSIS OF PENTENES. *Ind. Eng. Chem.* 38, 1187-1193 (1946) *November.*

Various pure pentenes were pyrolyzed at 700-800°C. and 0.1-0.25 partial pressure (nitrogen diluent). Butadiene was the major diolefin produced from both 1-pentene and 2-pentene. From 2-pentene, over 55 mole per cent of butadiene was received in the primary process as well as 5-10 mole per cent of 1, 3-pentadiene. An appreciable decomposition to light olefins was observed in the pyrolysis of the normal pentenes. Thus from pentene-1, 80 mole per cent ethylene and 45 mole per cent propylene were the primary products. Isoprene was the principal diolefin from the pyrolysis of the tertiary pentenes, although a small amount of butadiene was produced simultaneously. The Rice free radical chain theory must be modified to account for all the observed primary reactions.

C. H. Riesz

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## 10. CHEMICAL ENGINEERING

### Absorber Efficiency Evaluation

Ragatz, E. G. and Richardson, J. A. EVALUATION OF ABSORBER OPERATING EFFICIENCY. *Oil Gas J.* 45, 89-100 (1946) *November* 26.

The authors have recently analyzed the operating characteristics of some 40 commercial columns ranging in pressure from 30 to 1,800 psig. From this study they have developed a technique for evaluating absorber performance which utilizes an experimentally derived absorption factor chart in place of the classical Brown chart, and which gives promise of fully correcting the limitations of the conventional theoretical method.

Editor's abstract

### Flow of Gases

Brown, G. P., DiNardo, A., Cheng, G. K. and Sherwood, T. K. THE FLOW OF GASES IN PIPES AT LOW PRESSURES. *J. Applied Phys.* 17, 802-813 (1946) *October.*

The theory of flow at very low pressures is reviewed. The authors derive a general formula in the form of Poisenille's law with a correction factor included. This correction factor, which takes care of molecular effusion and slip at the pipe or tube walls, has been correlated with a dimensionless group of flow variables quite successfully. A generalized design chart is given.

J. D. Parent

### Gas Absorption Kinetics

Danby, C. J., Davoud, J. G., Everett, D. H., Hinshelwood, C. N. and Lodge, R. M. THE KINETICS OF ABSORPTION OF GASES FROM AN AIR STREAM BY GRANULAR REAGENTS. *J. Chem. Soc.* 1946, 918-934 (*October*).

A theoretical treatment is given of the kinetics of the removal of a gas from an air stream by passage through a column of granular solid with which it reacts or by which it is irreversibly absorbed. Various practically important relations are determined for typical systems and compared with those predicted theoretically. These relations include: (a) the escaping concentration as a function of time, column length, flow-rate and initial concentration, (b) the distribution of gas or reaction product in the column, and (c) the influence of granule size. The independent parts played by capacity factors and rate factors are shown.

Author's abstract

### Separation of Butadiene by Azeotropic Distillation

Poffenberger, N., Horsley, L. H., Nutting, H. S. and Britton, E. C. SEPARATION OF BUTADIENE BY AZEOTROPIC DISTILLATION WITH AMMONIA. *Trans. Am. Inst. Chem. Engrs.* 42, 815-826 (1946) *October-December.*

A description of the process and plant used to separate butadiene from butanes and butylenes by azeotropic distillation with ammonia is presented. Azeotropic compositions and vapor-liquid equilibrium data, upon which the separation depends, are given, together with solubility phase diagrams of the systems butylene-ammonia and butylene-ammonia-water, upon which the two processes used to recover ammonia were based. The distillation is unusual because the ammonia-hydrocarbon azeotropes at the plant operating pressure all have the same boiling point.

Author's abstract

## 11. PROCESS EQUIPMENT AND INSTRUMENTATION

### Fluid Catalytic Cracking Equipment

MacDonald, M. AUTOMATIC CONTROL OF A FLUID CATALYTIC CRACKING UNIT. *Petroleum Refiner* 25, 471-474 (1946) *October.*

The article describes the fluid catalytic cracking process, illustrating it by a simplified flow diagram, then states some of the more important problems which were unique with the process and tells how they were solved. Pressure differential recorders and controllers were used extensively since the catalyst behaves like a fluid and the pressure differential in a carrier line is a function of its flow. However, the pressure taps had to be kept free of catalyst which would plug the line leading to the instrument. This was done by the addition of a complete bleed air system which allowed air to flow into each tap at a predetermined rate that would keep the tap free of catalyst. The overall automatic control design of this process required the control of six systems interlocked with or related to the main oil system. Design of the control of each has been made with consideration of its effect upon the others. The six are: the catalyst, carrier air, aeration air, slurry, waste heat steam, and bleed air systems. Some of the instrumentation problems which arose were due solely to the physical magnitude of the equipment. It is interesting to note that one slide valve weighs 9 tons. The unit handles 17,000 barrels of oil per day.

J. J. First

## 12. MATERIALS OF CONSTRUCTION

### Corrosion

West, J. R. CORROSION OF CONSTRUCTIONAL MATERIALS BY SULPHUR AND SULPHIDES. *Chem. Eng.* 53, 225-238 (1946) *October.*

This report is a digest of a literature survey and a compilation of information from 135 industrial concerns, both users and producers of constructional materials, on the effect of sulphur, especially molten and vapor, on such materials. The materials which are discussed are the following: aluminum, cast iron and carbon steel, ceramics, fused silica, chromium, copper and its alloys, lead, magnesium, manganese, nickel and its alloys, platinum, silver and its alloys, and stainless steel. The effect of sulphides in solution upon cast iron, steel, stainless steel, magnesium and its alloys, nickel, Monel, Inconel and silver and its alloys is briefly treated. One paragraph of the report presents what little information is available on the corrosive effects of sulphur in solution.

J. J. First

### Corrosion Inhibitor

Justice, W. H. and Jones, E. N. TESTS AT CYCLING PROJECT DEMONSTRATE POSSIBILITIES OF NEW CORROSION INHIBITOR. *Oil Gas J.* 45, 86-87, 100 (1946) *November* 9.

Tests of Kontol 115 (Treto-lite Co.) as a corrosion inhibitor of gas-condensate wells have been made in the West Tuleta Field, Bee County, Texas. Kontol 115 is a semi-polar organic reagent that is chemically attracted to metal surfaces forming a protective film and inhibiting corrosive attack on the metal. This inhibitor is soluble in oil and does not form precipitates with calcium and magnesium salts, making it suitable for injection into the well annulus without danger of plugging the producing formation. Coupon corrosion tests and iron determinations of the produced water indicate the inhibitor to be effective.

C. B. Folkrod

### Corrosion Resistant Alloys

Fontana, M. G. NEW ALLOYS FOR SEVERE CORROSION SERVICES. *Chem. Eng.* 53, 114-115 (1946) *October.*

Two new corrosion resistant alloys were this month put on the market by the Duriron Co. They are Chlorimet 2, a nickel-molybdenum alloy and Chlorimet 3, a nickel-molybdenum-chromium alloy. Both are high alloys (that is, having an alloy content of approximately 97 per cent), have good mechanical and machinable properties and are suitable for handling all concentrations of sulfuric acid, hydrochloric acid, wet chlorine, sodium chloride, hot acetic acid, bleach solutions and many other chemicals. They are expected to find their biggest use as materials for pumps and valves.

J. J. First

### Directory of Construction Materials

DIRECTORY OF MATERIALS FOR THE CONSTRUCTION OF CHEMICAL EQUIPMENT. *Chem. Eng.* 53, 110-119 (1946) *November.*

This portion of Chemical Engineering's Twelfth Report on Materials of Construction provides a quick means of identifying materials available for the construction of chemical plant equipment. Generous cooperation on the part of the manufacturers has made it possible to include nearly 600 items. Materials are arranged alphabetically within each of seven classes of materials.

Author's abstract

### High Temperature Alloys

Binder, W. O. ALLOYS FOR HIGH TEMPERATURE SERVICE. *Iron Age* 158, 46-52 (1946) *November* 7.

This is the first part of a two-part article which presents a survey of pre-war and more recent developments in high temperature alloys. A tabulation of characteristics of steels for satisfactory high-temperature service is given, followed by methods of evaluating alloys on the basis of these characteristics. Pre-war high temperature alloys are classified and discussed under pearlitic or martensitic steels, ferritic steels, austenitic steels and nickel-chromium-iron alloys. The author treats present heat-resisting alloys under work hardened alloys, heat treated alloys and cast alloys, as the general group headings. The most promising alloys and their composition are enumerated and their properties described. In conclusion of this portion of the article the author presents a study of the effects of various alloying elements in enhancing high temperature properties.

J. J. First

### High Temperature Alloys

Binder, W. O. ALLOYS FOR HIGH TEMPERATURE SERVICE. *Iron Age* 158, 92-95 (1946) *November* 14.

The effects of strain hardening, heat treatment, and grain size control, in enhancing desirable qualities of the various types of alloys for high temperature service are reviewed, supported by quantitative test data. The author also stresses the importance of characteristics such as fatigue endurance, damping capacity and weldability in determining the suitability of the alloys for use at elevated temperatures.

Editor's abstract

### Resistance of Construction Materials

CHEMICAL RESISTANCE OF CONSTRUCTIONAL METALS AND NON-METALS. *Chem. Eng.* 53, 120-150 (1946) *November.*

From data supplied by the manufacturers the editors of Chemical Engineering have compiled this table showing the resistance of materials to 24 common and troublesome chemicals. Also shown are some of the important applications in which the materials are being used.

Editor's abstract

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## 13. NEW BOOKS

### Fuels and Combustion

Griswold, J. FUELS, COMBUSTION AND FURNACES. *New York, McGraw-Hill Book Co.*, 1946.

The book is written as a chemical engineering text. The chapters are entitled: Coal and Coke; Petroleum and Natural Gas; Mixture Properties of Petroleum Fractions; Combustion Stoichiometry; Temperature Enthalpy, and Heat of Combustion; Equilibrium and Kinetics; The Combustion Process; Manufactured Gas; Gas Burners; Oil Burners; Stokers and Pulverized Coal Burners; Introductory Heat Transmission; Furnace Refractories; Firebox and Chimney Considerations; Tube Heaters; and Process Furnaces and Kilns.

R. S. Goodrick

### Physical Chemistry

Glasstone, S. TEXTBOOK OF PHYSICAL CHEMISTRY. Second Edition. *New York, D. Van Nostrand Co.*, 1946.

Glasstone's Physical Chemistry is too well known to require a detailed description. The new edition retains the original arrangement of material with comparatively few changes. The most important, and most welcome, change is the revision of the section on thermodynamics and the adoption of a convention of symbols conforming with the systems most commonly used in the contemporary literature. The section on subatomic and nuclear chemistry has been enlarged to include the many important developments of recent years. The book is undoubtedly the most useful reference book in physical chemistry now available in the English language.

S. Katz

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